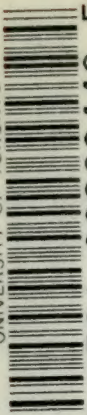


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THE HARVEIAN ORATION

1913



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THE HARVEIAN ORATION

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THE
HARVEIAN ORATION

ON

The Influence of Harvey's Work in the
Development of the Doctrine of
Infection and Immunity

*Delivered before the Royal College of Physicians
of London, on October 18th, 1913*

BY

J. MITCHELL BRUCE, M.A., M.D.

LL.D. ABERD. (HON.), F.R.C.P.I. (HON.)

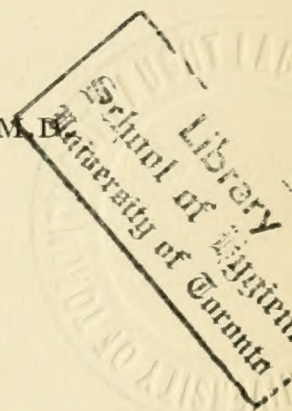
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To

SIR THOMAS BARLOW, BART.

K.C.V.O., M.D., LL.D., F.R.S.

PRESIDENT OF THE ROYAL COLLEGE OF PHYSICIANS

OF LONDON

A TOKEN OF DUTIFUL RESPECT AND

SINCERE PERSONAL REGARD

THE HARVEIAN ORATION

1913

MR. PRESIDENT,—It is my privilege and duty to-day to interpret the spirit that moved Harvey when he instituted this annual Feast and Oration, and to convey to the Fellows and Members in appropriate form the message that he left us for all time.

Harvey's character is reflected in his deed of gift. His devoted attachment to the College and solicitous thought for her corporate interests in the future are seen in his direction to the Orator to commemorate Benefactors and exhort others to imitate them. On this occasion I cannot do so more fittingly than by reminding you of the reference that you, Sir, made a few months ago, in your eulogy on the life and character of the late Dr. Theodore Williams, to the intention that he expressed in his will to leave conditionally to the College the sum of £5,000. Dr. Williams had proved his filial interest in the College in other ways during his life; and in this promised gift, which he directed to be devoted to hospitality and the maintenance of the dignity of the College, he

has done more than set us an example of liberality which each of us, as far as in him lies, should strive to follow. He has approved in deed what he commended in word from this very place two years ago—the cultivation and practice of the custom of generous social entertainment within the College, that the “mutual love and affection,” which it is also my duty to exhort my hearers to “continue,” may not be a passing sentiment during our individual lives, but be perpetuated in the fortunes of the College itself, of which it is one of the surest guardians.

Harvey's remaining direction to the Orator reveals what lay as close to his heart as the advancement of “the Society” itself. In pious conformity therewith I have now to exhort the Fellows and Members to search and study out the secrets of Nature by way of experiment. To those of our Fellows who are pure scientists, and to that other happily considerable number of our Fellows and Members who devote part of their time to exact research, I need offer a passing salutation only—they are working on Harvey's own lines. But what, I have had to ask myself, am I to say by way of exhortation to the general body of our Fellows and Members, who, leading laborious lives full of professional and other concerns, may easily lose in their routine work the opportunities and methods of scientific observation? I will exercise, yet in all humility as being myself one of their number, the privilege of the

position of brief authority to which you, Sir, in your great kindness have elevated me to-day, and will offer them a word of counsel on a subject which Harvey himself selected when about to address a body of practising physicians.

In the fifth Canon of his *Prelectiones Anatomiae Universalis*, the rough notes which he prepared to serve as guides in his Lumleian Lectures, Harvey gives the first place among "exotic" subjects to causes. He plans "to bring in points beyond mere anatomy in relation to the causes of diseases and the general study of Nature, with the object of correcting mistakes and of elucidating the use and action of parts . . . for the use of anatomy to the physician is to explain what should be done in disease." *Ob causas Morborum: Medicis praecipue utilissimas* are the opening words under the head of *observationes exoticas*; *et inde Quid agendum morbis* are the concluding words of this pregnant Canon; and the two expressions are linked together by two others—"the general study of Nature" (*varietatem Naturae philosophicae*) and "the structure and functions of the body" (*constitutionem naturalem*), indicating the scientific connexion of the first and last. Note that this is no casual remark of Harvey. It represents the plan of his lectures, deliberately worked out, carefully formulated, and no doubt closely followed.

Reflecting on this passage in the history of Harvey as a lecturer, I asked myself what came

out of the striking declaration, "*Causas Morborum Medicis praecipue utilissimas,*" in the course of the next two hundred and fifty years. Harvey's declaration was in the possession of his successors, many of them, no doubt, his pupils; his life and methods were annually held up to their contemplation as an example to follow; and he had also left to them in his writings, as I shall presently remind you, certain profound reflections on contagion, immunity and spontaneous recovery, and—in the same connexion—on evolution, which might well inspire them. Moreover, the question of causation, particularly in respect of fever, was before the minds of thoughtful practitioners of the seventeenth and eighteenth centuries at every moment; and we know that the "proximate cause" of fever lay at the root of the different doctrines which exercised so much the minds of learned physicians and philosophers of the time, connoting as it did the reaction of the body to morbid agents, and indirectly the problem in what life itself consists.

I concluded that, instead of using words of formal exhortation, I should best fulfil my duty of to-day by reviewing with you the history of the doctrine of the causes of fever from the death of Harvey to the present time. The development of that doctrine might be expected to prove the value of Harvey's reiterated affirmation that in the solution of the problems of medicine experiment (which, as he used the term, included "diligent

observation ") leads to success, whilst "empty assertions, mere suppositions and false sophisticated reasonings" end only in error, confusion and delay.

Let us see what contributions the physicians of those days, working in different fields and following different methods, respectively make to the knowledge of infectious diseases and the natural history of contagion within and without the body. I say "working in different fields," for there were two fields of observation and action largely independent of each other in which physicians had opportunity to unravel the theoretical and practical problems connected with the origin and nature of fever.

The first field was that of the men who practised, and in many instances spent their lives, in the very circumstances in which fever was bred and spread—in the slums of London and other cities, in connexion with jails, and in the naval and military services. They had the problem of prevention as well as that of treatment constantly before their minds, and they already deserved the name of sanitarians. The other field was that of the clinical observers in civil hospitals and in the West-end of London, away from the hotbeds of infection. Their interest in fever concerned its phenomena and the indications to be found in them for guides to treatment, and they gave little thought to the insanitary conditions in which the disease arose.

I begin with the observers of fever in its breeding places. It was they who insisted on the connexion of contagion with insanitation, and traced out the social circumstances in which insanitation arises; and it was from their observations and earnest, persistent representations that public health legislation in this country took its beginnings. At the time of the death of Harvey in 1657 they were already in possession of the knowledge that epidemic diseases arise from contagion and dirt, and they had only too many occasions of confirming and applying it.

During the one hundred and fifty years from that date to the first decade of the nineteenth century the descriptions of conditions under which fevers flourished in the civil population of this country, and in the naval and military services, by competent medical observers like Mead, Lind, Pringle and Smollett, are almost revolting. General poverty and ignorance, and hand-to-mouth existence breaking down when famine happened to prevail, led to overcrowding into tenements in towns, where men, women and children lived wretched and dissolute lives, without the smallest provision for a supply of wholesome water, or the removal of dejecta, effluvia and dirt of other kinds. Ventilation was at a premium, for the window tax had fallen on habitations, and also on jails and prisons maintained and worked on a corrupt proprietary system and crowded with debtors and criminals alike. The

inmates of these, on their release, spread fever in town and country, or were immediately pressed into ships of the Royal Navy, which were ready to be infected because of the entire absence of means of ventilation.

Along with these miserable circumstances of the bulk of the population there prevailed during most of the eighteenth century among the governing classes of the country a lamentable indifference to other concerns than their own immediate privileges and pleasures. Even when blessed with peace abroad the country did not turn to domestic reform. Prosperity and unwonted ease begot improvidence. Drunkenness was so much the resource of the poor and the fashion of the well-to-do that in 1726 the College made a representation on "the fatal effects of the frequent use of distilled spirituous liquors" on the individual and on the race to the House of Commons, through Dr. Freind, one of its Fellows and Member for Launceston. The pens of Fielding and Smollett and the brush of Hogarth inform us of the coarse joviality, grossness and vice of the times; and we can study for ourselves in story and in picture the utterly insanitary — indeed, filthy — conditions in which the people lived, and from time to time by the thousand died. Fever and death raged discontinuously in the form of destructive epidemics throughout the whole of the eighteenth century.

In those times of physical and social corruption

the foundations were laid of preventive medicine in England, and after England in the world, by the isolated efforts of a few medical men. In 1720 Richard Mead, a Fellow of the College and physician to St. Thomas's Hospital, published his *Short Discourse concerning Pestilential Contagion and the Methods to be used to Prevent it*, in response to an appeal by the Government for advice. Plague was raging in France, and must be prevented from entering England. With this object Mead recommends a strict quarantine. If it should invade the country, it must be prevented from spreading; and in this matter Mead is a genuine reformer. He condemns the system of shutting up infected houses, the sick and the healthy together, until all have either died or recovered—a system which drives people to conceal the disease at its beginning, and lets loose the survivors to spread fresh infection. He recommends the establishment of a Council of Health, with local officials to isolate infected persons, to cleanse sound persons and remove them to new lodgings. No expense is to be spared to save the nation from the greatest of calamities. Infected houses should be pulled down and their contents burned, all habitations made clean and airy, streets washed, beggars provided for in hospitals, and unnecessary assemblies prohibited. The Government of the day, thoroughly alarmed—obviously in part for their individual safety—gave effect to Mead's recommendations by Act of Parliament, but within a

year, moved by faction, they repealed part of its provisions.

Thirty years later there was published in a Letter to Dr. Mead *Observations on the Nature and Cure of Hospital and Jail-Fevers*, by John Pringle, Fellow *speciali gratiâ* of the College. In 1750 the court at the Old Bailey was infected by putrid effluvia brought by prisoners from Newgate, and two judges, counsel, the Lord Mayor and others—more than forty persons in all—perished: the sixth Black Assize. Pringle, who had studied typhus intimately in camps and military hospitals when Physician-General to the Forces, and traced the connexion of it with putrid air, filth, damp and other causes, including conditions of place and season, recommended a system of ventilation which was carried out. In those early days, as again a century later, civil sanitation learned some of its best lessons from the Army Medical Service.

Work of equal value in the investigation of the causes and prevention of disease in the British Navy was done at the same time and during the next twenty or thirty years by Dr. James Lind, physician to Haslar Hospital, and Dr. Gilbert Blane. Lind identified “ship fever,” “jail fever,” and “hospital fever” as all one disease with typhus—an advance of incalculable value in its bearing on the spread of infection. He not only traced typhus and scurvy to their respective origins in the unwholesome conditions of routine ship life, but he showed how to prevent them.

Observations to the same effect were being made in the civil populations of London and other cities. This was the period of Dr. John Hunter, who in a paper to the College identifies the typhus of the West-end of London with the jail and hospital fever of his military experience, and gives a graphic description of the poverty and consequent insanitation of the people; of Samuel Johnson's Dr. Robert Levett,

“Of every friendless name the friend,”

who laboured among the poor behind Fleet Street; of Lettsom in the City, who carried his patients out into the cold fresh air, and wondered at the long neglect of the method; of Dr. John Fothergill, who recommends “free air” for the putrid sore throat, first recognised and described by him in this country; and of Willan, who as physician to the public dispensary attended the poor of the district between the Strand and Holborn and of the City, and traced the invasion and complete depopulation of some parts of it by fever to life in overcrowded and foul habitations.

But we must be fair in our record. Another influence than medical science was at work in England in the middle of the eighteenth century—a growing influence of common humanity in social politics. It is true that it was as administrators, in their different offices and spheres of public activity, that Pringle on the battlefield, Gilbert Blane afloat and ashore, Lind at Haslar, Captain Cook in com-

mand of the *Resolution*, and John Howard on his first memorable visit to a county prison, severally started a movement which was destined to mitigate incalculable suffering, save countless lives, and elevate the masses physically and morally. But these men were gifted with noble and tender hearts as well as intelligent minds, and in that respect they appear in the history of Preventive Medicine as the outstanding representatives of "the large sympathy of man with man, which," in the eloquent words of John Richard Green, "especially marks the eighteenth century as a turning point in the history of the human race."

But legislation does not at once wait on sentiment. By the end of the eighteenth century nothing of value was done in the way of providing a public supply of water to serve as wholesome drink and to remove sewage, nor was there any provision for dealing with epidemics, although 1796 will ever be memorable as the year in which Jenner discovered the value of vaccination by strictly scientific experiments. The first visitation of cholera in 1831 found the country still entirely unprepared in respect of sanitation to prevent the spread of infection. Not even yet was there any proper drainage system: every house was built over its own cesspool. Of nuisances there was no public control. General alarm, begotten of reports from the Continent of the ravages of cholera, and a growing acquaintance with the insanitary state in which the people were living, led to the

establishment of a Board of Health, after a consultation between the Privy Council and the College; its President, Sir Henry Hallford, becoming President of the Board. *Rules and Regulations* for the purpose of preventing the introduction and spreading of the disease were circulated, which related to sanitation in detail, but mostly were of no binding effect on the public; and what the condition of insanitation of most of our towns was in relatively recent times may be gathered from the record that in 1847 typhus killed over 30,000 persons in England and Wales, and typhoid fever 78,000 persons in the ten years 1871–1880.

It is humiliating to unravel the moving force that at last set Parliament in action, and led to the Public Health legislation of 1848. What neither medical representations and offers of medical assistance, backed by recent advances in chemistry, physics, physiology and pathology, nor the growth of common humanity could effect, excepting in piecemeal fashion on grave occasions, was prompted and promoted by considerations of economy. The high mortality from fever had cut off in their prime thousands of breadwinners, leaving their widows and children paupers, and it had also reduced to temporary destitution those who survived. The poor rate had risen to an alarming height, and the Poor-law Commissioners, tracing this increase ultimately to public insanitation, represented to the Government in 1838 that prevention would be more economical than mitigation.

Their appeal was backed by reports 'from' three distinguished physicians—Dr. Neil Arnott, Dr. James Philip Kay and Dr. Southwood Smith—on the prevalence of physical causes of fever in the metropolis and the prevention of them. As compared with Dr. Mead's *Short Discourse*, drawn up one hundred and eighteen years earlier, there is little that is new in these reports, in respect either of the description of general insanitation and misery and their fatal effects on the population, old and young, or of the principles on which public measures were recommended to correct them. The economic argument prevailed; and the appointment of a Royal Commission on the Health of Towns in 1843 was followed by various legislative steps, and finally by the Public Health Act in 1848.

From that date to the present time the machinery of public sanitation, so hard to set in motion, has undergone continuous development. Exact science was waiting to assist it—at first spontaneously, afterwards with the help of Government grants through the Privy Council or Local Government Board on the recommendation of Simon. The two agents which their predecessors had continuously associated with fevers—contagion and dirt—were being thoroughly investigated. In 1849 Snow referred the spread of cholera to the infected dejecta, and ten years later it was definitely traced to contamination of the water-supply. First one and

then another medium of infection hitherto unsuspected was discovered—particularly by Greenhow's historical enquiries on industrial diseases, and the investigations into the connexion of scarlet fever, diphtheria and summer diarrhœa with milk, and of typhoid fever with water. In the last fifty years the progress of sanitation on scientific lines has been rapid and uninterrupted. Of this there is no better evidence than the series of lectures on State Medicine and Public Health, delivered in the College since 1888 under the bequest of Dr. Gavin Milroy, a true benefactor whom it is my duty to commemorate specially on this occasion.

I am content to close this portion of the history of the etiology of fever in 1858. In that year Pasteur sterilised water, and by a simple-looking experiment finally solved the problem of the relation to each other of the two extrinsic elements of infection—contagia and their media.

This review, necessarily brief and fragmentary as it is, serves to illustrate how much can be achieved by immediate, well directed and exact observations, unprejudiced consideration of facts, and intelligent and successful application of the resulting knowledge by way of experiment conformably with Harvey's model. To me the most instructive features of it are the incalculable amount of public good that was effected

by English sanitarians before either the nature of contagion or the rôle of the media of its growth and spread was discovered; and that ignorance in these two respects did not shake their conviction of the existence of what they could not define, nor tempt them from their field of practical work into idle speculation or into heartless resort to antiquated authority. They were true to Harvey's memorable commentary on the criticism passed by some of his contemporaries on his own work "as throwing obstacles in the way of their explanations" of the phenomena of the circulation in disease: "the facts cognisable by the senses wait upon no opinions, and the works of Nature bow to no antiquity. . . . There are many things we admit in physiology, pathology and therapeutics the causes of which are unknown to us—the causes of putrid fevers . . . among the number."

Let me now return to the year 1657, and from the death of Harvey to the present time survey the other field of observation of fever—of fever in its clinical relations. Physicians in hospital and in better-class practice, not immediately concerned with a pestilence but with cases of illness in individual patients, studied causation in its bearing on treatment only. In the clinical phe-

nomena of fever and in its course towards either recovery or death they, like their predecessors from immemorial times, recognised manifestations of a struggle between morbid matter, infection, τὸ θεῖον, and a power possessed by the body of spontaneous resistance and recovery, a *vis naturae*.

According to Sydenham the remote causes of fever are particles in the air which insinuate themselves into the body and are mixed with the blood, and also the various ferments or putrefaction of humors which are detained in the body beyond their due time—the “auto-infections” of to-day. Fever, he says, is Nature’s instrument whereby she separates the impure from the pure: inordinate commotion of the blood, the cause or companion of fever, is stirred up by Nature. Cullen, who practised a hundred years later, and with Sydenham may be taken to represent the practical type of physician of those times, describes the remote causes of fever as chiefly some matter floating in the air, specific contagions and miasmata, and the proximate cause as the reaction of the system to the remote causes, “the same,” he says, “with what Hippocrates called Nature.” And the main indication or object of treatment of fever is to assist Nature in her methods.

So far physicians of the seventeenth and eighteenth centuries worked on sound lines. Their doctrine of fever was essentially the same as the accepted pathology of fever at the present

time, "a wonderful specimen," says Sir Thomas Watson, "of the sagacity of the older physicians—of the despised wisdom of our forefathers." And to this extent they were in mutual agreement.

But they were not satisfied. Difficulty, error and disagreement commenced with attempts to interpret the details of the struggle in the body—the individual symptoms of fever. They neglected Harvey's counsel to take time and gather facts. Let us be fair to them. Unless they were pure empirics like Sydenham, who scoffed at their pseudo-scientific doctrines and methods, they had to find in the symptoms of fever, and in its course, individual indications for the management of the rigors, the vomiting, the headache, the delirium, the increasing debility, and the other kinds of disorder and distress that called for relief. Where knowledge failed them as a guide they turned to speculation. This they did although they did not know in what either of the two antagonists in fever, contagion and the *vis medicatrix Naturae*, consists. The constitution of contagion they gave up as an insoluble problem. Sydenham declares that the remote causes of fever, whether particles in the air or putrefaction in the body, "are wholly inscrutable," "have no manner of commerce with the senses," "taking up the vain speculations of curious men," and if known would be unnecessary for use as indications in treatment. "We know nothing," says Cullen, "of the nature of

contagion that can lead us to any measure for removing or correcting it"; and by him the question remained wholly disregarded.

On the other hand, speculation and dissent were endless respecting the *vis Naturae*—that is, the structural and functional constitution of the living body, and on the question how and in what respects it is *medicatrix*. Thus there arose in succession the many different doctrines of fever (as many as there were of the nature or secret of Life itself, on which in large measure they were based) that constitute so large a part of medical literature from the time of Sydenham to the beginning of the nineteenth century. Indeed the same story of fresh and ever diverse speculations and therapeutic systems continued well into the reign of Queen Victoria. And, paradoxically, the advance of physics, chemistry and physiology by Newton, Boyle, Mayow, Lower and others stimulated premature speculation instead of controlling it. In each new doctrine of fever, as it arose, one can trace the influence of a recent discovery in science, adapted to support some theory of life and disease, woven into the tangled web of mediæval dogma.

Sylvius, impressed by Harvey's discovery, asserts that fever proceeds from increased velocity of the circulation. Effects of the publication of the *Principia* are seen in the views of Archibald Pitcairn and his friend Lorenzo Bellini, who explained all the phenomena of fever as

the results of mechanical processes; and in Boerhaave's teaching that it is to be accounted for by increased capillary resistance and "too quick contraction of the heart" through the medium of the nervous system, including the cerebellum. Cullen as distinctly was impressed by Haller's discovery of the irritability and sensibility of the tissues. His statement of the doctrine of fever will serve as sufficient illustration of the way in which what you, Sir, call transcendental speculation usurped step by step the place of sober description. According to him, the remote causes of fever act on the nervous system, and produce debility in the action of the extreme vessels. This, through the intervention of the *vis medicatrix Naturae*, forms an indirect stimulus to the circulation, and vascular spasm and increased action of the heart are the result. The energy of the brain and the extreme vessels is thereby restored, the spasm is overcome, and sweat and other excretions are set free. On the other hand, John Brown held that fever is an asthenic state of the system arising from an obstruction of the natural stimuli, or from exhaustion, direct or indirect, of its excitability. At the beginning of the nineteenth century comes the doctrine of Broussais, supplemented by the theories of Clutterbuck and of Armstrong, that fever is always symptomatic of local inflammation. From this doctrine, and the depletive treatment based on it, there was early reaction. In 1834

Graves strongly condemns "general explanations of the causes of disease" as having "more than any other circumstance contributed to retard the progress of medicine. We live," says he, "among systems." Nor did matters soon mend. Within the lifetime of some of us here to-day the pathogeny of fever, and the notions of the causation of disease in general, appear to the student of the history of medicine to have been chaos.

To such a pass had unsupported assumption displaced knowledge, that facts established for many centuries were discarded. In whatever way we may account for it, men for a time lost hold of the two causal agents in fever which, as we have just seen, were recognised as clearly by Sydenham as they are recognised to-day—contagion and spontaneous resistance. With regard to the latter, Sir John Forbes, as late as 1857, in a work on *Nature and Art in the Cure of Disease*, protested against the prevalent neglect, indeed the ignorance, of a natural influence making for recovery. As for the nature of contagion, even Stokes in his *Lectures on Fever*, after combating a view prevalent at the time that insanitation alone without contagion may originate fever, expresses the opinion that "the same exciting cause—at least as far as we can see of it—is capable of producing different kinds of fever in different persons"; and, observing that the production of fever was inconstant while insani-

tation was constant in many parts of Ireland, he quotes without dissent Graves's opinion that they were not to expect any notable diminution of fever from the operation of drainage, improved habits of cleanliness, and increased comforts. Sir Thomas Watson in 1857 also has to argue at length in favour of the existence of contagion; and in the same connexion he confesses that, until Jenner's differentiation of typhoid from typhus, he had taught that the differences in the aspect and phenomena of continued fever depended more upon what is called the epidemic constitution than upon any essential difference in the nature of the disease itself, or in the virus from which it sprang.

This is a moving chapter in the comparatively recent history of medicine, where we find men of higher intelligence than many of us could claim—keen, methodical, laborious, accurate observers—searching in vain for a rational pathology of fever which an almost immediate future was going to reveal. And coming to Murchison, one of my own teachers, after Jenner the highest authority on fevers in England, it is difficult for me to realise that I am already separated from him by the great interval of doctrine if not of time that these words of his published in 1873 reveal:

“We have it in our power not only to arrest the spread of continued fevers, but in many cases to prevent their origin. The parasitic theory rests solely on analogy and is unsupported by facts. If

all contagious diseases can arise in no other way than by contagion, their germs must be both omnipresent and indestructible by time. There are certain contagious diseases, such as erysipelas, pyæmia and puerperal fevers, whose origin *de novo* may be said to be a matter of almost daily observation, and which, in fact, we have almost the power of generating at will. For these reasons and others there are good grounds for believing that contagious fevers have occasionally an independent origin.”

Thus the two hundred years passed; and now we may compare the results achieved in the respective fields of observation of fever. Preventive Medicine was by this time well founded on established facts: the existence of contagion, the circumstances under which it is bred, the media by which it reaches man, and the influence of sanitation in favouring both individual exposure and individual receptivity. Clinically, on the other hand, physicians of the mid-Victorian period were in respect of the pathology of fever in no better—indeed partly in less good—position than Sydenham: the very existence of contagion questioned, the specificity of the different fevers disputed, spontaneous generation of fevers supported by abundant argument, spontaneous resist-

ance and recovery as provisions inherent in the body ignored or mentioned in derision. A single exception, the confirmation of the difference between typhus, typhoid and relapsing fevers, already maintained on the Continent and in America, was the result of work conducted strictly on Harveian lines, mainly by Jenner. Events as a whole proved the wisdom of Harvey's counsel, and the need of frequent exhortation to make it, in his own words, "our first duty to inquire whether the thing be or not before asking wherefore it is."

If I have succeeded in convincing you by the illustration I have chosen which of the two methods of studying out the secrets of Nature is the correct one, judged by their respective results, let me now ask you to be generous to the observers whose method stands condemned. Many physicians of the period made and recorded observations of great value on the clinical characters and course of different outbreaks of fever. And the problems before them were of a different order from those which met the sanitarian, and more difficult of solution; indeed, they were insoluble without the help of pure science. Two great secrets of Nature had to be searched out, and the materials of which the keys were forged that were to unlock the secrets had to be found—*anatomical, chemical, biological and pathological*. For this event, being practising physicians, they did not

wait. After all, the very errors into which they fell, in their desire to help their patients, provoked discussion and research, and indirectly promoted progress. Far better the trial and error of those times than the stagnation of thought and effort of the dark ages from Galen to Vesalius.

The confusion of view that surprises us in this record as prevalent so late as 1873 was one of the signs of dawn of two great discoveries, which were presently to illuminate the field of the pathology of infections ; indeed, the whole field of the origin of disease. The period between the years 1859 and 1880 is all-eventful in the history of the pathology of fever and of infection generally. The contagia of certain febrile diseases were proved by Pasteur, Lister and Koch to be living vegetable organisms ; those of certain other febrile diseases by Lewis, Obermeier and Laveran to be living animal organisms. Contagia were parasites, and vegetable parasites were linked up with animal parasites, already recognised from the earliest ages of medicine.

The two fields of observation which I have surveyed now became common ground ; and the sanitarian, the clinician and the family doctor found themselves working as you, Sir, have said on adjacent areas inseparably connected. And the greatest modern triumph of preventive treatment was gained when Lister, in the practice of

remedial treatment, demonstrated the success of his antiseptic method.

Close on the discovery of the essential nature of contagia came another, complementary of it, the discovery of immunity, passive and active, the product of a function resident in the blood, and exercised by it on occasion whether natural or artificial, that is, experimental. This second discovery, based essentially on the first, was the work of Roux, Buchner and Behring on the chemical side, of Metchnikoff on the biological side, phagocytosis connecting fever once more with inflammation. The faculty of immunity was the second agent in fever, so long searched for in vain. The discovery of it was a fresh recognition of a fact established at the latest in the time of Hippocrates. The *vis medicatrix Naturae* was re-established after its temporary dispossession and degradation, and by a new method—by experiment and under a new name.

And now the question arose, How comes this spontaneous resistance to contagia and this spontaneous recovery from the effects of them, *vis conservatrix et medicatrix*, to exist? Was there nothing to be found, by what Harvey in his fifth Canon called “the general study of Nature,” to serve as a link between parasitism and immunity in fever?

The link was already found in evolution. Darwin's *Origin of Species* had appeared in 1859, the year in which Pasteur succeeded in sterilising water. It is now accepted that our body is protected against unfavourable influences under the law of the survival of the fittest, which governed, and still governs, its evolution ; and that when the provisions for protection prove insufficient, and disorder or disease arises in consequence of the evolution of man being still incomplete, whatever his destiny may be, other provisions, also the result of natural selection, come into play, controlling, or at least moderating, morbid agents and their effects, and repairing structural and functional damage. And presently it came to be accepted, further, that artificial selection can be employed to assist natural selection, and that this is to be done by Public Sanitation, which not only deals directly with contagion and the media of infection, but by improving the material and moral circumstances of living also builds up resistance in the individual from childhood onwards, and through the individual ultimately in the race—and to unfavourable influences of many other kinds than organised infections.

The history of the development of the pathogeny of fever shows us that men as well as facts

had to be waited for. Darwin, Pasteur, Lister, Koch, Metchnikoff and Behring had to arise. But let me remind you that they have to share with Harvey the honour of reaching their great inductions.

Now and again in the course of his writings Harvey discloses trains of thought on the Natural History of Life and Disease. In pursuing his immediate investigations he comes on some fact correlated with that subject. He grasps the significance of it as only a genius could grasp it, states the same in a few pregnant words, and turns from it back to his present concern.

I will read to you a few passages from *De Generatione*. The first of these relates to the nature and spread of contagion :

“Let physicians . . . cease to wonder at what always excites their astonishment—namely, the manner in which epidemic, contagious and pestilential diseases scatter their seeds and are propagated to a distance through the air, or by some ‘fomes,’ producing diseases like themselves in bodies of a different nature, and in a hidden fashion silently multiplying themselves by a kind of generation, until they become so fatal and with the permission of the Deity spread destruction far and wide among man and beast.”

The second passage relates to the *vis medicatrix Naturae*. What opinion did Harvey offer of it and its significance? No opinion. Of all the observers in these two hundred years, as far as I

can find, Harvey alone offers us an experiment instead:

“I have myself (says he) for experiment’s sake occasionally pricked my hand with a clean needle, and then having rubbed the same needle on the teeth of a spider I have pricked my hand in another place. I could not by my simple sensations perceive any difference between the two punctures. Nevertheless there was a capacity in the skin to distinguish the one from the other, for the part pricked with the envenomed needle immediately contracted into a tubercle, and by and by became red and hot and inflamed, as if it collected and girded itself up for a contest with the poison for its overthrow”: a perfect experiment, proving, as Harvey puts it, that “the flesh itself readily distinguishes a poisoned wound from one that is not poisoned.”

Next, by a simple observation, unpremeditated and unprejudiced, but to him full of significance, he discovers in the organs of defence and escape in animals another order of provisions possessed by the body against disease:

“To those animals (he tells us) to which Nature has given vast strength she has also presented weapons in harmony with their powers: to those that are not thus vigorous she has given ingenuity and cunning and singular dexterity in avoiding injury.”

The most highly developed means of protection Harvey sees in intelligence:

“Man (says he) comes into the world naked and unarmed, as if Nature had desired that he should be guided by reason rather than by force; therefore did she endow him with understanding and furnish him with hands, that he might himself contrive what was necessary to his clothing and protection.”

Having thus outlined in a few words the different orders of provisions for survival in the struggle for existence possessed by the individual—automatic, instinctive and voluntary—Harvey surprises us by proceeding in the next sentence of *De Generatione* to forecast the correlated law of sexual selection:

“Ornaments of all kinds (according to his observations), such as tufts, crests, combs, wattles, brilliant plumage, and the like, to say nothing of such offensive weapons as teeth, horns, spurs, and other implements employed in combat, are more frequently and remarkably conferred upon the male than the female . . . the subject of dispute being no empty or vainglorious matter, but the perpetuation of the stock in this line or in that, as if Nature intended that he who could best defend himself and his should be preferred to others for the continuance of the kind. . . . Nor is this ornamenting anything adventitious and for a season only: it is a lasting and special gift of Nature, who has not been studious to deck out animals and especially birds only, but has also thrown an infinite variety

of beautiful dyes over the lowly and insensate herbs and flowers."

These four brief discussions constitute a single great conception, in which Harvey, by way of experiment and intelligent observation, which it has been my privilege and duty this day to exhort you to follow, came near to unlock the very secret of Nature's secrets, the relativity of life, the reaction of Man to the influences of his environment, whether favourable to his existence and health, or unfavourable to them—constituting the causes of disease and death. This conception is alone sufficient to justify the admiration and reverence which the College all these hundreds of years has entertained for the man whose work and character are our chief glory.

And in this connexion let me once more impress upon you the consideration that Harvey is distinguished from his early followers by his restraint from speculation, the self-restraint of the true scientist. Having revealed his conception of the ways and working of Nature as it occupied his mind, he represses himself and resumes the place and attitude of a simple, patient observer, content to accumulate and record facts, and to leave speculation to time and his successors. Harvey's prevailing hope and desire was that his work and his method of work might be continued, that the prospect which he saw opening before him, but still distant, might one day be reached by others.

Truly says John Simon of Bacon and Harvey:
“ Noble eloquence and nobler example had taught lessons which never again could be lost from men’s minds as to the spirit and method of all scientific research—that system of modest and patient interrogation through which alone any knowledge of Nature will grow.”

Post Scriptum.—The Orator desires to acknowledge the assistance obtained in the preparation of this study from Simon’s *English Sanitary Institutions* and Dr. Charles Creighton’s standard treatise, *A History of Epidemics in Britain*.

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The Harveian oration
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